International Research Journal of Microbiology Vol. 12(4) pp. 1-3, July, 2023
Available online http://www.interesjournals.org/IRJM

Review Article

Implementation of Bacteriophage in Food Production and Processing

Pablo Garica*

Department of Microbiology, Ghent University, Spain

*Corresponding Author's E-mail: pablogarica@gu.ac.sp

Received: 3-July-2023, Manuscript No. IRJM-23-106580; **Editor assigned:** 5-July-2023, PreQC No. IRJM-23-106580 (PQ); **Reviewed:** 19-July-2023, QC No. IRJM-23-106580; **Revised:** 22-July-2023, Manuscript No. IRJM-23-106580(R); **Published:** 29-July-2023, DOI: 10.14303/2141-5463.2023.55

Abstract

Despite numerous advancements in food sanitation and pathogen surveillance, foodborne illnesses continue to be a major cause of hospitalization and death worldwide. Customary antimicrobial techniques, like purification, high tension handling, light, and compound sanitizers are equipped for diminishing microbial populaces in food sources to shifting degrees, yet they additionally have significant disadvantages, for example, an enormous beginning speculation, likely harm to handling gear due to their destructive nature, and an injurious effect on organoleptic characteristics (and perhaps the healthful esteem) of food sources. Maybe above all, these sterilization systems dispense with unpredictably, counting numerous frequently useful microorganisms that are normally present in food varieties. One promising method that tends to a few of these weaknesses is bacteriophage biocontrol, a green and regular technique that utilizes lytic bacteriophages separated from the climate to target explicitly pathogenic microbes and dispose of them from (or fundamentally lessen their levels in) food sources. Since the beginning origination of utilizing bacteriophages on food varieties, a significant number of examination reports have portrayed the utilization of bacteriophage biocontrol to focus on different bacterial microorganisms in different food sources, going from prepared to-eat store meats to new products of the soil, and the number of economically accessible items containing bacteriophages supported for use in food handling applications has additionally been consistently expanding. However a few difficulties remain, bacteriophage biocontrol is progressively perceived as an appealing methodology in our arms stockpile of devices for securely and normally wiping out pathogenic microscopic organisms from food varieties.

Keywords: Foodborne illness, Food sanitation, Antimicrobial techniques, Destructive nature, Organoleptic characteristics, Bacteriophage bio control

INTRODUCTION

The foods we eat are always at risk of being contaminated by microbial pathogens, which can then be passed on to the consumer. This risk is present in everything from the cheddar cheese and leaves of lettuce in a Cobb salad to frozen pre-cooked meals. The World Health Organization (WHO) recently established the Foodborne Disease Burden Epidemiology Reference Group (FERG) to keep an eye on foodborne illness worldwide. The 31 foodborne pathogens that were responsible for the greatest human morbidity and mortality were tracked by FERG. According to FERG's most recent (2015) estimate of the global burden of foodborne illness, 600 million foodborne infections caused over 400,000 deaths in 2010. Of the main five microorganisms causing foodborne ailment, four were microbes: Escherichia coli (~111 million), Campylobacter spp. (~96 million), non-typhoid Salmonella enterica (~78 million), and Shigella spp. (51 million), with estimates ranging from 15,000 for Shigella spp. for the number of foodborne-related deaths caused by these bacteria. to ~63,000 for E. coli (Scharff RL, 2012).

Our foods' safety is improved through a variety of methods. Heat purification is usually used to lessen bacterial numbers in fluids and dairy things, most quite milk. Nonetheless, purification isn't appropriate for some new food things, as the cycle brings about the things being cooked. One more strategy used to decrease microbes in food varieties is High Strain Handling (HPP) which uncovered food sources to high strain to inactivate organisms. This method has been effectively utilized on fluiditems and pre-prepared dinners, intended to be frozen; notwithstanding, likewise with heat sanitization, it is for the most part not utilized with new meats and produce, as it can influence the appearance (variety) and additionally nourishing substance of these items. Also, irradiation is a good way to cut down on the amount of harmful bacteria in food. However, irradiation can have a negative impact on foods' organoleptic qualities; Additionally, this method has low customer acceptance, which is exacerbated by the requirement to label many radiation-treated food items. At long last, compound sanitizers, like chlorine and peracetic corrosive (PAA), are generally used to diminish microbial foreign substances of many new natural products what's more, vegetables as well as Prepared To-Eat (RTE) food items. While they are, as a general rule, successful, large numbers of these synthetic substances are destructive and can harm food handling hardware. Compound sanitizers can likewise perniciously influence the climate (i.e., not harmless to the ecosystem) and, with the current patterns toward compound free, natural food sources, shopper acknowledgment of substance added substances in food varieties (especially in new produce) is declining quickly. The fact that all of these methods kill microbes randomly is a common drawback; at the end of the day, both the pathogenic as well as possibly worthwhile ordinary greenery microscopic organisms are designated similarly. Additionally, food borne outbreaks continue to occur relatively frequently despite the availability of numerous methods. These variables joined outline the requirement for a designated antimicrobial methodology, one that can be utilized alone or in blend with the methods depicted above, to lay out extra hindrances in a multi-obstacle way to deal with forestalling food borne bacterial microbes from arriving at shoppers (Wolbang CM, 2008).

Phage bio-control for focusing on normal foodborne bacterial microbes

Listeria monocytogenes: Listeria monocytogenes is a Gram-positive, facultative anaerobe with a rod shape. Humans experience a variety of symptoms when they consume foods contaminated with L. monocytogenes, including initial flu-like or gastrointestinal symptoms that, in some instances, progress to encephalitis or cervical symptoms, and possibly stillbirth in pregnant women. Global cases of foodborne L. monocytogenes infection were estimated to exceed 14,000 in 2010 with over 3,000 deaths. L. monocytogenes can grow and survive at temperatures between 2 and 8 °C, which are typically used for the distribution and storage of many foods; thusly, the recognition and end of L. monocytogenes is fundamentally critical to guaranteeing the security of the pecking order, particularly in RTE food varieties. In this specific situation, the utilization of bacteriophages to arranged food sources (counting RTE food varieties) has been shown, by a few examiners, to be compelling at decreasing tainting with L. monocytogenes. For instance, a business monophage readiness (i.e., phage planning comprising of one single phage) focusing on Listeria was accounted for to be successful in decreasing the degrees of L. onocytogenes in cut ham, and to be better than nisin and sodium lactate, when analyzed at the capacity misuse temperature of 6-8 ◦C. The same monophage preparation was also able to reduce L. monocytogenes on the surface of other deli meats, as Chibeu and colleagues (2013) demonstrated .The meats (cooked cut turkey and dish hamburger) were put away at 4 ◦C and the maltreatment temperature of 10 ◦C. The Listeria-explicit phage was powerful against L. monocytogenes when utilized alone, and it upgraded the viability of different antimicrobials when utilized along with sodium diacetate or potassium lactate. This multitude of studies used a solitary phage planning. A phage mixed drink ready with various bacteriophages contrasted with a solitary phage readiness might be prevalent, both as far as giving more extensive inclusion of the objective species and of decreasing the gamble of safe microscopic organisms arising (Bajovic B, 2012).

Salmonella spp: The non-typhoid serotypes of Salmonella enterica are responsible for numerous annual cases of gastroenteritis all over the world. The illness brought about by these Gram-negative, pole molded microscopic organisms is frequently self-restricting, with side effects ordinarily including stomach cramps, fever, sickness and looseness of the bowels. However, dehydration and an invasion of the gastrointestinal tract by the bacteria can result in life-threatening situations. Non-typhoid Salmonella is estimated to have caused over 78 million foodborne infections worldwide in 2010, resulting in nearly 60,000 deaths. Salmonella and other pathogens can adhere to the surfaces where food is prepared during processing and packaging, contaminating those surfaces (Suklim K, 2014). These variables place RTE food varieties, like new natural products what's more, vegetables that are not cooked prior to eating, at an especially high gamble for communicating bacterial microbes and causing food contamination. Somewhere around two FDA-cleared Salmonella-focusing on phage arrangements are presently available. A few distributions are accessible depicting their applications (and that of other noncommercial phage arrangements) in different food varieties provides brief summaries of those studies. One study is especially interesting because it provides an example of how to deal with phage-resistance in situations where it reduces a bacteriophage preparation's effectiveness. In that review, a GRAS-recorded (For the most part Perceived as Protected) six-phage mixed drink focusing on Salmonella was inspected for its capacity to decrease the degrees of Salmonella on surfaces copying those generally tracked down in food handling foundations, e.g., treated steel and glass . Starting examinations showed that the Salmonella-explicit bacteriophage mixed drink essentially diminished the number of inhabitants in powerless Salmonella stresses on all surfaces analyzed by ~2-4 logs; simultaneously, it was incapable in lessening the levels of one more kind of Salmonella (Salmonella Paratyphi B S661) that was impervious to the phage mixed drink in vitro. However, the updated preparation showed a significant reduction (2 logs) of S. Paratyphi B S661 from the surfaces when the phage cocktail was modified to include phages specifically targeting this resistant strain. This resulted in the phage cocktail remaining effective against the previously susceptible isolates. This study gives indisputable proof that phage mixed drinks can without much of a stretch be changed to target explicit bacterial strains, e.g., if phage-safe freaks arise, or to explicitly focus on the issue strains pervasive specifically food-fabricating offices (Wheeler TL, 1999).

Bacteriophage arrangements as business items

Preparation of bacteriophages under control: The number of regulatory approvals for bacteriophage preparations and their use to improve food safety has steadily increased over the past approximately 12 years. The FDA gave the first approval for a bacteriophage preparation to be used directly in food supply in 2006 for the L. monocytogenes-specific cocktail ListShieldTM as a food additive (the FDA does not “approve” any products, phage-based or not; However, obtaining FDA approval to use products for their intended uses is commonly referred to as "approval." Later that year, the FDA approved the Listeria-specific preparation Listex TM, which is now PhageGuard ListexTM, as a substance that was Generally Recognized as Safe (GRAS). The Food and Drug Administration (FDA) has granted GRAS designation to a number of phage products in recent years, including SalmoFreshTM and PhageGuard STM. Application for GRAS designation now appears to be the standard method of approval for phage products designed to treat post-harvest foods (Beuchat LR, 1997). The GRAS designation does appear to be an appropriate regulatory avenue for such preparations because wild-type (i.e., not genetically modified) lytic bacteriophages are all natural and already inherent in the food supply. Additionally, a number of phage preparations have been included in the USDA's guidelines for safe and appropriate ingredients for the production of meat, poultry, and egg products (Sohaib M, 2016) (Sulakvelidze A, 2001).

Challenges for bacteriophage biocontrol

A growing body of literature attests to the utility of bacteriophages to reduce or eradicate their targeted pathogenic bacteria in foods, as described in the preceding sections. Bacteriophage biocontrol is increasingly being used to target specific pathogenic bacteria in various foods. In any case, a few difficulties actually stay before bacteriophage biocontrol is all the more broadly acknowledged, counting specialized requirements and the overall purchaser acknowledgment of phage application on food varieties. A portion of these difficulties are momentarily examined underneath (Perera MN, 2015) (Sulakvelidze A, 2013).

CONCLUSION

However a few difficulties remain, bacteriophage biocontrol is progressively acknowledged as a safe furthermore, successful strategy to take out, or altogether diminish the degrees of, explicit bacterial microorganisms from food varieties. A growing number of nations have granted approval for the use of commercial bacteriophage products. These items can be utilized to address tainting by explicit bacterial microbes at an assortment of timepoints during food creation, including splashing on produce, applying to domesticated animals creatures prior to handling, washing of food contact surfaces in handling offices, and treatment of post-reap food items, including RTE food sources. Foodborne illnesses remain a constant threat, particularly for those with weaker immune systems, such as children, the elderly, and pregnant women, despite advancements in food safety. In a multi-hurdle approach to preventing foodborne pathogens from reaching consumers, bacteriophage biocontrol can be used as an additional tool. This method is especially promising when food processors want to preserve the natural, often beneficial, microbial population of foods and only remove the bacteria that can cause illness in humans.

REFERENCES

1. Scharff RL (2012). Economic burden from health losses due to foodborne illness in the United States. J Food Prot. 75: 123-131.
2. Wolbang CM, Fitos JL, Treeby MT (2008). The effect of high pressure processing on nutritional value and quality attributes of Cucumis melo L. Innov Food Sci Emerg. 9: 196-200.
3. Bajovic B, Bolumar T, Heinz V (2012). Quality considerations with high pressure processing of fresh and value added meat products. Meat Sci. 92: 280-289.
4. Suklim K, Flick GJ, Vichitphan K (2014). Effects of gamma irradiation on the physical and sensory quality and inactivation of Listeria monocytogenes in blue swimming crab meat (Portunas pelagicus). Radiat Phys Chem. 103: 22-26.
5. Wheeler TL, Shackelford SD, Koohmaraie M (1999). Trained sensory panel and consumer evaluation of the effects of gamma irradiation on palatability of vacuum-packaged frozen ground beef patties. J Anim Sci. 77: 3219-3224.
6. Beuchat LR, Ryu JH (1997). Produce handling and processing practices. Emerg Infect Dis. 3: 459-465.
7. Sohaib M, Anjum FM, Arshad MS, Rahman UU (2016). Postharvest intervention technologies for safety enhancement of meat and meat based products; a critical review. J Food Sci Technol. 53: 19-30.
8. Sulakvelidze A, Alavidze Z, Morris JG (2001). Bacteriophage therapy. Antimicrob Agents Chemother. 45: 649-659.
9. Perera MN, Abuladze T, Li MR, Woolston J, Sulakvelidze A (2015). Bacteriophage cocktail significantlyreduces or eliminates Listeria monocytogenes contamination on lettuce, apples, cheese, smoked salmon and frozen foods. Food Microbiol. 52: 42-48.
10. Sulakvelidze A. Using lytic bacteriophages to eliminate or significantly reduce contamination of food by foodborne bacterial pathogens. J Sci Food Agric. 93: 3137-3146 (2013).